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UNITED STATES
DEPARTMENT OF THE INTERIOR
J. A. KRUG, SECRETARY

BUREAU OF MINES
JAMES BOYD, DIRECTOR

REPORT OF INVESTIGATIONS

INVESTIGATION OF POTATO MOUNTAIN TIN PLACER DEPOSITS SEWARD PENINSULA, NORTHWESTERN ALASKA

BY

HAROLD E. HEIDE AND F. A. RUTLEDGE

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By Harold E. Heide[2] and F. A. Rutledge[3]

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INTRODUCTION AND SUMMARY

Although the United States has been the largest consumer of tin, only a small quantity of tin was produced on the North American Continent during peace times, and the deficiency was made up by foreign imports.

Because the most important sources of tin were cut off by the war with Japan, it became necessary to increase imports from South America and Africa and, if possible, develop domestic tin reserves. Most of the tin produced in North America has come from the Seward Peninsula, Alaska, and a substantial portion of this was produced from the Potato Mountain area.

Tin was first identified as occurring in the Seward Peninsula by A. H. Brooks in 1900, when a part of heavy concentrates from Anikovik River and Buhna Creek, one of its tributaries, proved to be stream tin.[4] His report was given considerable publicity by the daily press, and the first steamers north in 1901 carried a number of prospectors bound for the Seward Peninsula to search for tin. The deposits of stream tin on Buck Creek in the Potato Mountain area were discovered in the fall of 1901.[5]

1/ The Bureau of Mines will welcome reprinting of this paper, provided the following footnote acknowledgment is used: "Reprinted from Bureau of Mines Report of Investigations 4418."

2/ Senior mining engineer, Juneau, Alaska.

3/ Mining engineer, Juneau, Alaska

4/ Steidtmann, Edward, and Cathcart, S. H., Geology of the York Tin Deposits, Alaska: U. S. Geol. Surv. Bull. 733, 1922, p. 13.

5/ Idem. p. 14.

During the succeeding years the area was re-examined several times by the Geological Survey as a part of its program in Alaska. As a possible domestic source of tin for the United States, the area was examined by J. B. Mertie, Jr., geologist of the Geological Survey in 1939.

The Potato Mountain placer district produced approximately 1,500 tons of tin concentrate prior to 1920. Since then tin production in the district has been negligible.

As one of the strategic metals needed for the war industries, the Bureau of Mines, under the Strategic Minerals Act of 1939, began investigations of tin deposits on the Seward Peninsula. Reports that previous operators had left an appreciable amount of tin led to an examination of the district by the senior author in September 1942. The possibilities of developing a moderate tonnage of tin appeared encouraging, and a project by the Bureau of Mines was proposed.

The program of investigation was started by the Bureau of Mines on June 20, 1943, with two bulldozers and two placer drills. Work continued until September 22, 1943, when all of the principal creeks of the district, except Red Fox Creek, were drilled.

It was necessary to do considerable prospecting with the drills. As a result, there was not sufficient time to complete detailed drilling on the more favorable deposits discovered.

A field party of the Federal Geological Survey worked in the area during the program by the Bureau of Mines, and plane table maps made by the Survey form the base for illustrations incorporated in this report.

ACKNOWLEDGMENTS

The chemical analyses included in this report were made at Rolla, Mo., under the direction of C. Travis Anderson, metallurgist, Rolla Branch, Metallurgical Division.

Acknowledgment is made to the Geological Survey for the use of maps of the deposits in the Potato Mountain area and information obtained from their previous reports on the Seward Peninsula.

Special acknowledgment is made to Robert Coats, geologist of the Geological Survey, who was chief of party for the Survey during the cooperative project.

LOCATION AND ACCESSIBILITY

The Potato Mountain tin placer district embraces the tin-bearing creeks surrounding Potato Mountain. The district is in the northwest part of the Seward Peninsula, Alaska, at approximately 65° 40' north latitude and 167° 30' west longitude. The airline distances are 100 miles northwest of Nome, 12 miles east of the Cape Mountain tin placer district, 9 miles south of the Arctic Ocean and 12 miles north of the Bering Sea. Location of the district is shown on figure 1.

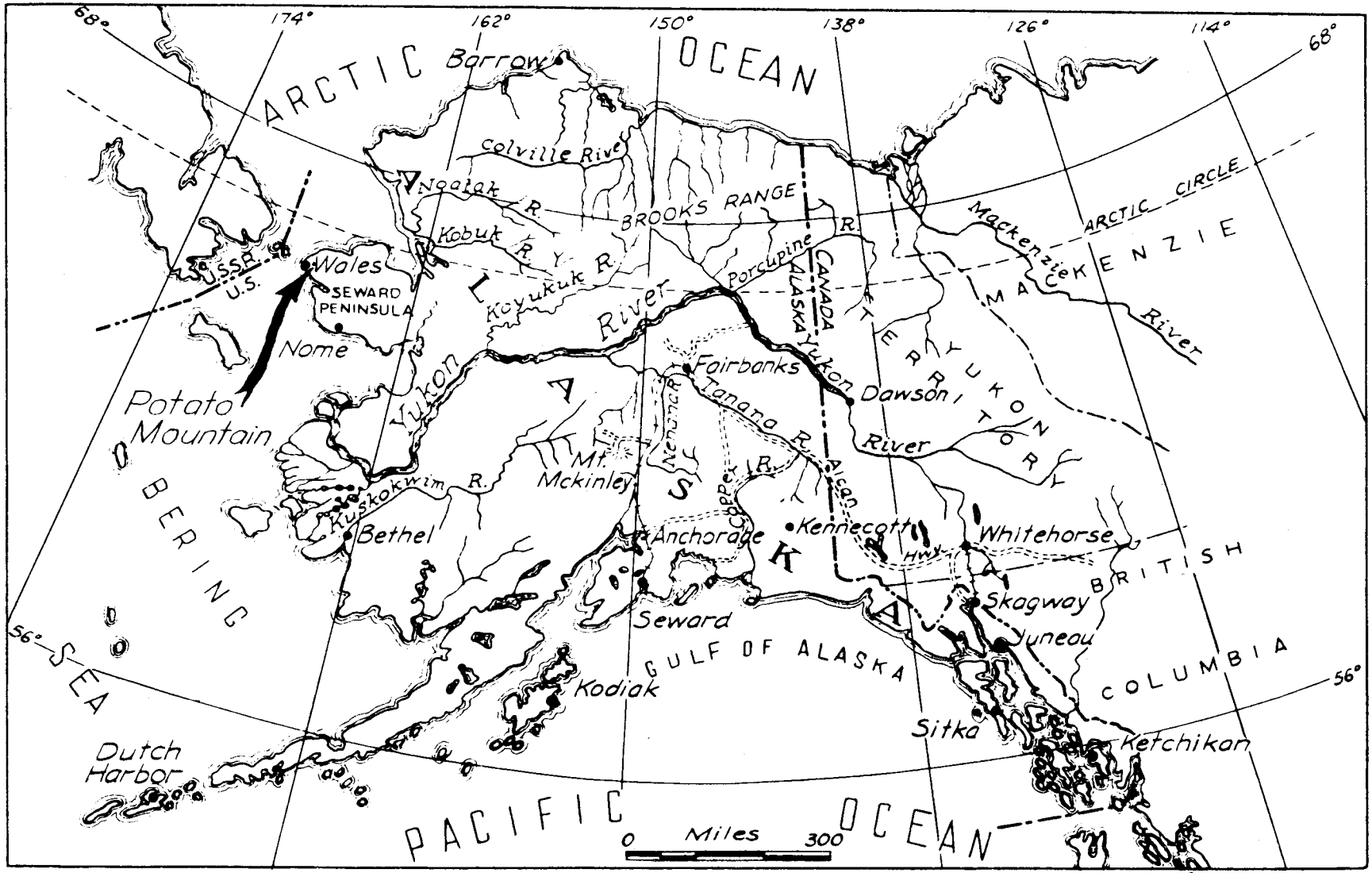

Figure 1. - Index map of Alaska.

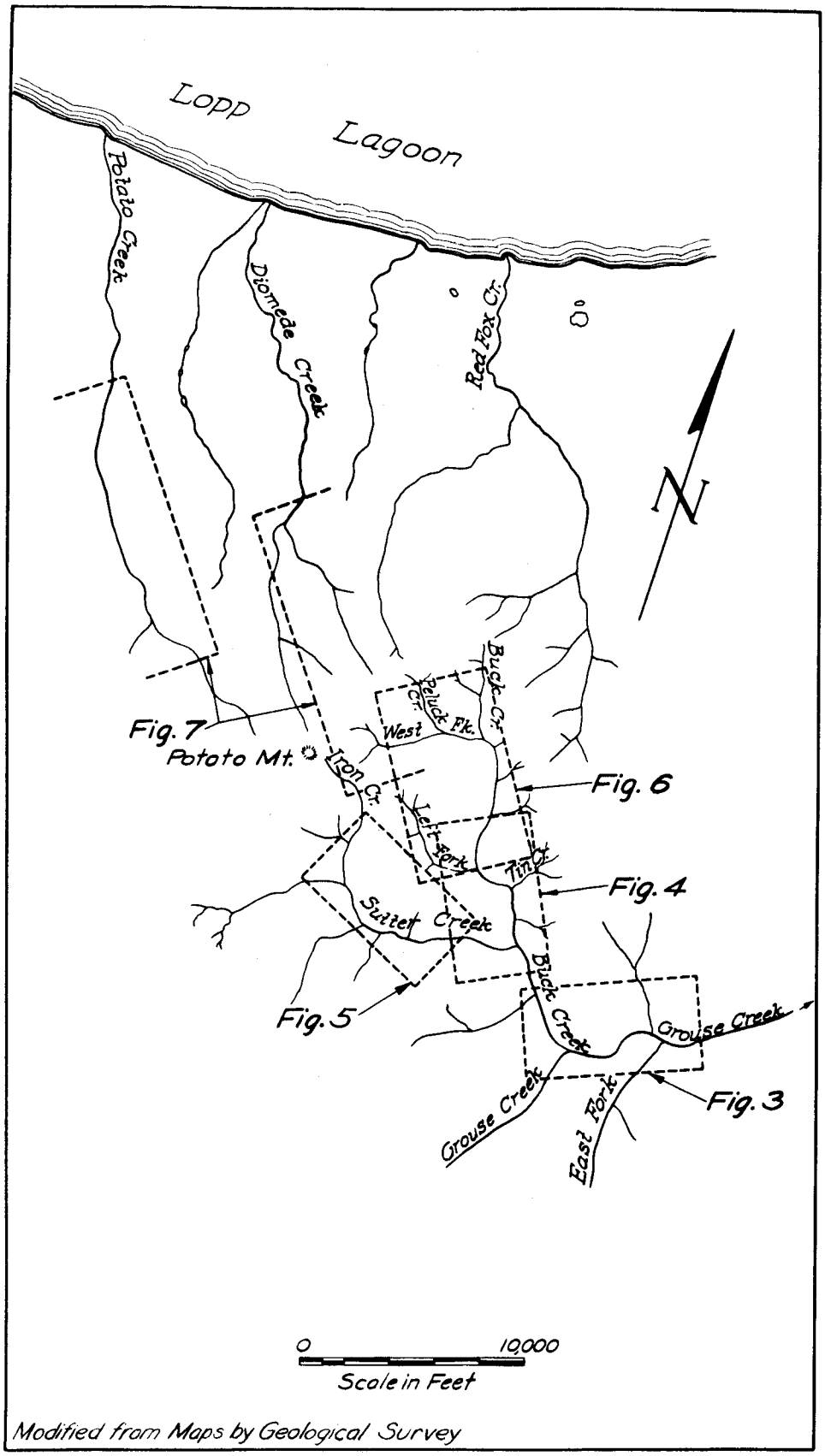

Figure 2. - Potato Mountain tin placer district.

A coastwise steamer makes two or three trips a year between Seattle and Kotzebue during the season when the Bering Sea is open to navigation. The first boat leaves Seattle early in June and the last boat late in August or early in September. There is no harbor at Tin City or Wales, and ships must anchor offshore, and cargoes are lightered ashore.

The average freight rate from Seattle to Nome is $30. a ton plus a 16-percent surcharge. Lighterage rates at Nome are 50 percent of the Seattle-Nome freight rates.

Supplementary coastwise service is provided by the mail boat, a small motor schooner scheduled to make biweekly trips between St. Michael, Nome, Wales, and Kotzebue. The schooner will also tow a barge from Nome to these villages and way points when cargoes justify. Freight rates by this method from Nome to York are about $30 a ton, shore to shore.

Prior to 1920, Buck Creek was reached by a wagon road from York near Anikovik River on the Bering Sea. The road is now impassable but could be repaired at a moderate cost. Tin City was used as a base during the Bureau of Mines' investigation, with transportation by means of tractors and go-devils.

The Bureau of Mines leveled a small airfield near the lower dredge on Grouse Creek. The field is short and suitable only for small planes.

PHYSICAL FEATURES AND CLIMATE

Potato Mountain consists of a series of hills 1,200 to 1,400 feet in altitude trending southwest and culminating in a peak bearing the name. The principal tin-bearing creeks heading in the low-lying hills are divided into two drainage systems. Grouse, Buck, Sutter, Iron, Left Fork, and Peluk Creeks are included in the southeast system; Potato, Diomede, and Red Fox Creeks flow northwest into the Arctic Ocean. The location of the principal creeks is shown on figure 2. These creeks are short, the valleys narrow, the water shallow, and the bedrock gradient steep near their heads.

No timber is available in the region, not even enough scrub willows to provide firewood. The tundra furnishes an abundant supply of moss, which is a suitable feed for reindeer but of little value for other stock.

Land animals once were plentiful, but at present the numbers have been greatly reduced. Only an occasional rabbit, ptarmigan, fox, or bear is seen. The partly domesticated herds of reindeer have been greatly depleted in recent years.

The climate of the region is Arctic. High winds from the north or south bring much fog and rain during the summer. Weather conditions at Potato Mountain are similar to those at Nome, where the nearest weather station is located. The records at Nome show an average annual precipitation of 12.29 inches. Over half of the rain falls during the 4 summer months, or from June to September, inclusive. The annual mean temperature is 30.2° F. Winters are severe, and temperatures of -40° F. are recorded frequently.

The ice pack on the Bering Sea stops navigation from early November to late June.

Most of the unconsolidated material under the tundra is frozen throughout the year and must be thawed before placer mining can be undertaken.

HISTORY AND PRODUCTION

Placer mining for tin started on Buck Creek in 1901 and continued until 1920. About 324 tons of concentrate containing 50 percent tin was produced in the earlier years by hand placer-mining methods. The York Dredging Co. commenced dredging operations on Buck Creek in 1911. The American Tin Co. started dredging on Buck Creek in 1915. Since 1911 the dredges recovered 1,194 tons of concentrate containing 68 percent tin. Small, scattered, high-grade tin placer deposits on the upper creeks of the southeast slope of Potato Mountain were worked by ground sluicing methods.

PROPERTY AND OWNERSHIP

Claim titles were not investigated, but it is reported that J. S. Ramstad, 320 N. 175th Street, Seattle, Wash., and associates control many of the placer claims on Grouse and Buck Creeks and their tributaries. It is also reported that Ramstad has leased his placer claims to Clifford Smith of Fairbanks, Alaska. Mrs. T. A. Peterson of Teller, Alaska, located several claims on Potato Creek in 1943.

WATER SUPPLY

The flow of water is too variable during and between seasons to make a reliable estimate of the quantity of water flowing in the creeks of the area. In September 1942, Buck Creek above Sutter Creek was nearly dry. It was reported that the upper dredge on Buck Creek was at times short of water for floating. According to prospectors who had hand mined on Buck, West Fork, Left Fork, and Iron Creeks, a sufficient supply of water was present only during the spring thaw and after each rain. To avoid interruption of mining operation, which would result in lower production and higher mining costs, it would be necessary to bring water to some of the deposits from the junction of Buck and Sutter Creeks. This water could be impounded and recirculated at the deposits. On deposits farthest from the junction of these creeks it would be judicious to plan a schedule of mining to conform with the periods of abundant water during the spring thaw.

CHARACTER OF THE DEPOSITS

On the southeast side of Potato Mountain the bedrock is slate, whereas on the northwest side both slate and conglomerate bedrock are found. Quartz veins that range from a fraction of an inch to a few inches in width are found almost everywhere in the area. It is believed that the cassiterite found in the placer deposits of the area came from these quartz veins.6/ However, no lode tin deposits of commercial grade have been found in the area.

6/ Op. cit., pp. 89-90.

The tin-bearing portions of the creek gravels in the Potato Mountain area, like those of Cape Mountain, are too small to represent any large reserve of tin.7/ The gravels have been mined, and deposits that remain were apparently left for economic reasons. Small tin-bearing areas left along the sides of old dredge and sluice channels and unworked low-grade portions of the creeks contain the known tin reserves of the district. The few deposits found by the Bureau of Mines are small and widely separated. If mining was undertaken, considerable operating time would be lost and considerable expense would be involved in the movement of equipment from one deposit to another.

The deposits average 40 to 100 feet in width, 3 to 13 feet in depth, and 500 to 3,000 feet in length. Distances between deposits range from 600 to 4,000 feet.

Most of the areas are covered with an overburden of tundra, slide rock, ice, and muck. The term "muck," as used by the Alaska Placer Miners, refers to materials composed of decayed organic matter, silt, clay, and some sand. The gravel is generally frozen, but is otherwise uncemented. It is fairly well washed, contains few boulders over 1 foot in diameter, and only a small amount of clay.

Although tin concentration is generally on or near bedrock, Bureau of Mines drilling indicates that tin concentrate does not penetrate far into the slate cleavages. Bedrock gradients range from 2 to 6 percent.

Tin in the placer deposits is found in small, slightly rounded cassiterite grains with a sparse occurrence of muggets. The particle size ranges from about 0.025 inch up to 0.2 inch in diameter. A high percentage of fines occur in the concentrate on Grouse Creek.

Small amounts of hematite, magnetite, and pyrite generally are found in all rough concentrates. Considerable hematite and magnetite are associated with the cassiterite on Grouse, lower Buck, and Iron Creeks.

Bureau of Mines drilling shows the presence of gold with the tin concentrates on Buck Creek in the vicinity of Sutter Creek and West Fork. A few holes show a higher content, but it is estimated that the general average gold content will not exceed $0.05 a cubic yard in value.

INVESTIGATIONS BY THE BUREAU OF MINES

The placer deposits were sampled by churn-drill holes and trenches. Two hundred fifty-six holes were drilled, totaling 2,880 feet. When possible, all drill holes were spaced at 50-foot intervals on lines across the tin-bearing deposits at right angles to the valley. The distance between lines was normally 500 feet. The purpose of the work was to determine the possible extent of the deposit up and down the valleys as well as the width.

7/ Heide, Harold E., and Sanford, Robert S., Investigation of Cape Mountain Tin Placer Deposits, Seward Peninsula, Alaska: Bureau of Mines Rept. of Investigations 4418.

The holes are numbered according to their location with respect to the center line of the valley. Facing downstream, the right side is referred to as the "right limit" and the left side as the "left limit." The prefix to the hole numbers, L. L. (left limit) and R. L. (right limit) are used on all figures. Location of the drill holes is shown on figures 3 to 7, inclusive.

On Buck and Grouse Creeks, where the gravel was previously mined by dredging, drill holes and drill lines were spaced with the object of locating tin-bearing areas along the margins of the mined section of the creek.

Two airplane-type churn drills were used - one a 4-inch drill using casing with a drive-shoe cutting area 0.150 square foot, and the other a 5-inch drill using casing with a drive-shoe cutting area of 0.230 square foot.

In thawed ground the length of core in the casing was measured before and after each pumping. Loose volumes from each pumping were measured in calibrated buckets. Open holes were drilled in frozen ground, and water measurements were made to determine the size of the holes. Logs were kept at the drill by the drillers, frequent checks being made by the sample foreman.

Preliminary panning was done by skilled Eskimo panners at the drills. A high recovery was obtained on a low-grade concentrate. Final cleaning of the concentrate was done by the sample foreman, who also panned the tailing to see that no tin was lost.

Two average tin analyses of the concentrate from each creek were obtained by segregating the concentrate samples from all holes on a creek into two composite samples. Segregation was based on weights; those samples weighing between 4 and 15 grams were segregated into one composite, and those above 15 grams were segregated into a second composite.

In applying the two average analyses, they were first reduced to a single average by weighing, the percentage of tin in the 4- to 15-gram composite sample against the percentage of tin in the 15 or more gram weights. (See table 1.) The percentages determined by this method were used when calculating the drill logs.

TABLE 1. - Tin analysis of composite concentrate of placer samples (Analysis at Bureau of Mines Laboratory, Rolla, Mo.)

Source of sample	Tin, percent	Weighted average, tin percent
Buck Creek (Grouse to Sutter) L 12 to L 16, Composite of samples between 15 to 4 grams	65.70	65.52
Buck Creek (Grouse to Sutter) L 12 to L 16, Composite of samples over 15 grams	65.50	
Buck Creek (Sutter to Left Fork) L 17 to L 24, Composite of samples between 15 to 4 grams	52.52	55.42
Buck Creek (Sutter to Left Fork) L 17 to L 24, Composite of samples over 15 grams	55.60	

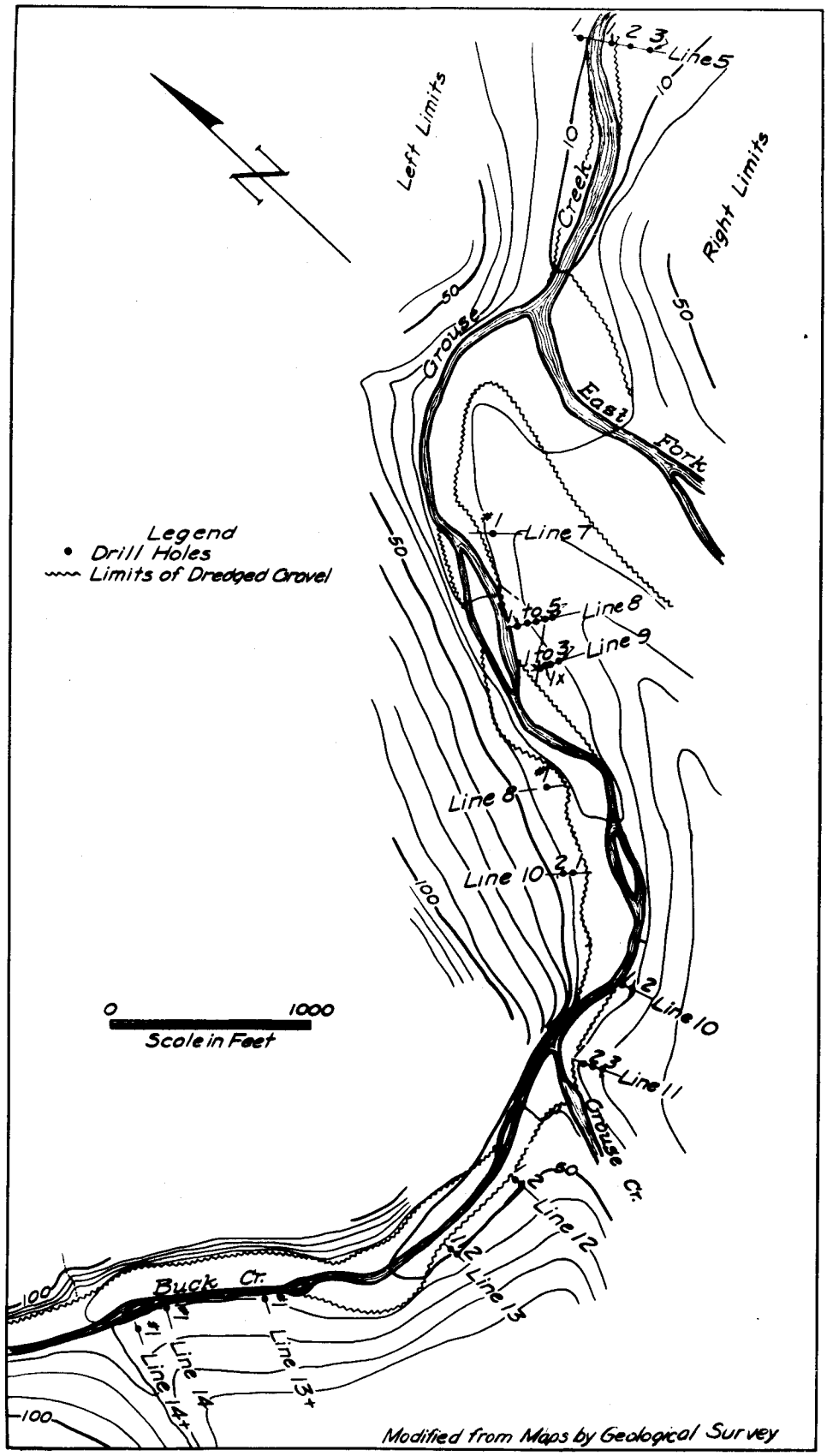

Figure 3. - Drill-hole map of Grouse and Buck Creeks.

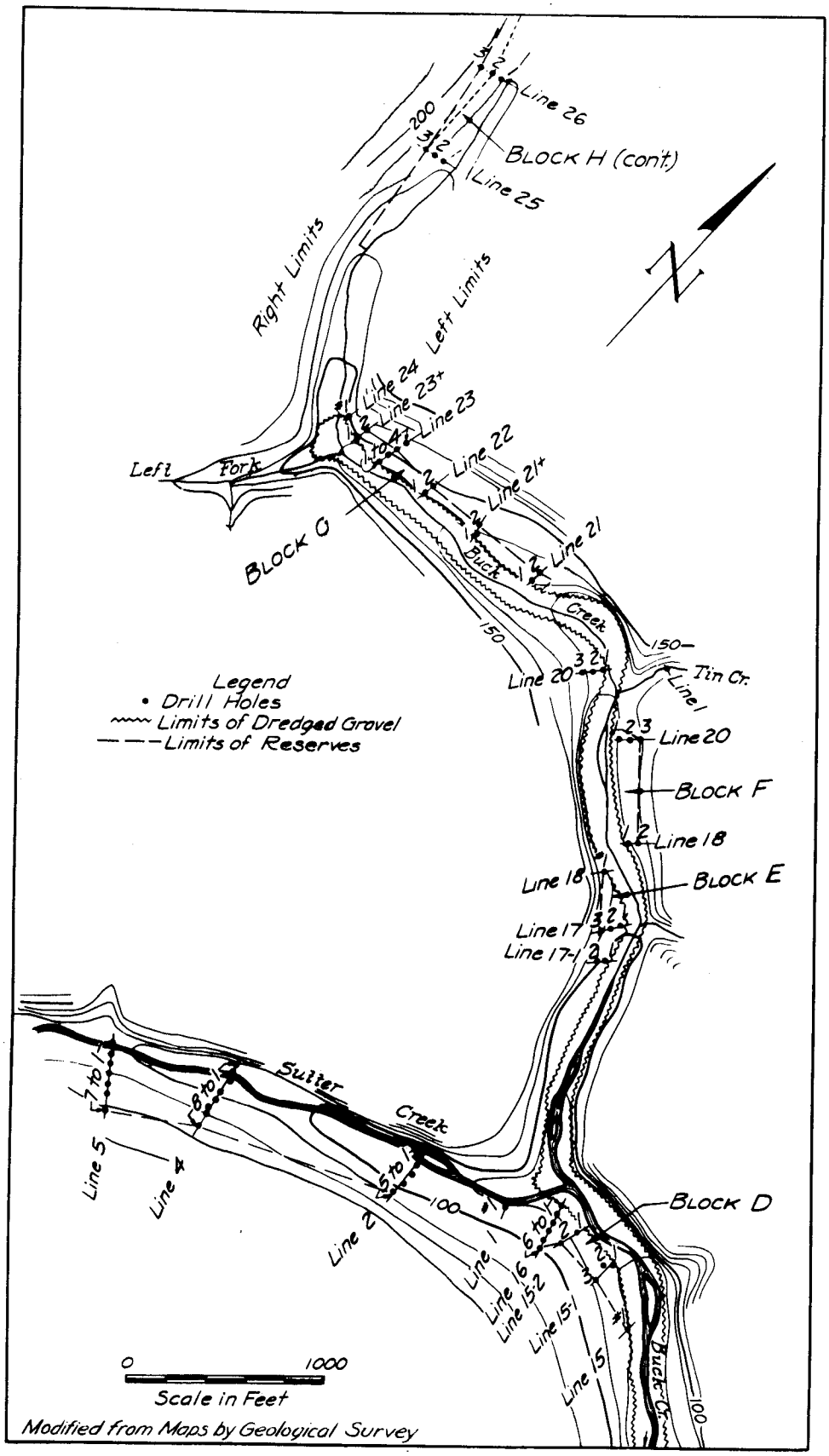

Figure 4. - Drill-hole map of Buck and Sutter Creeks.

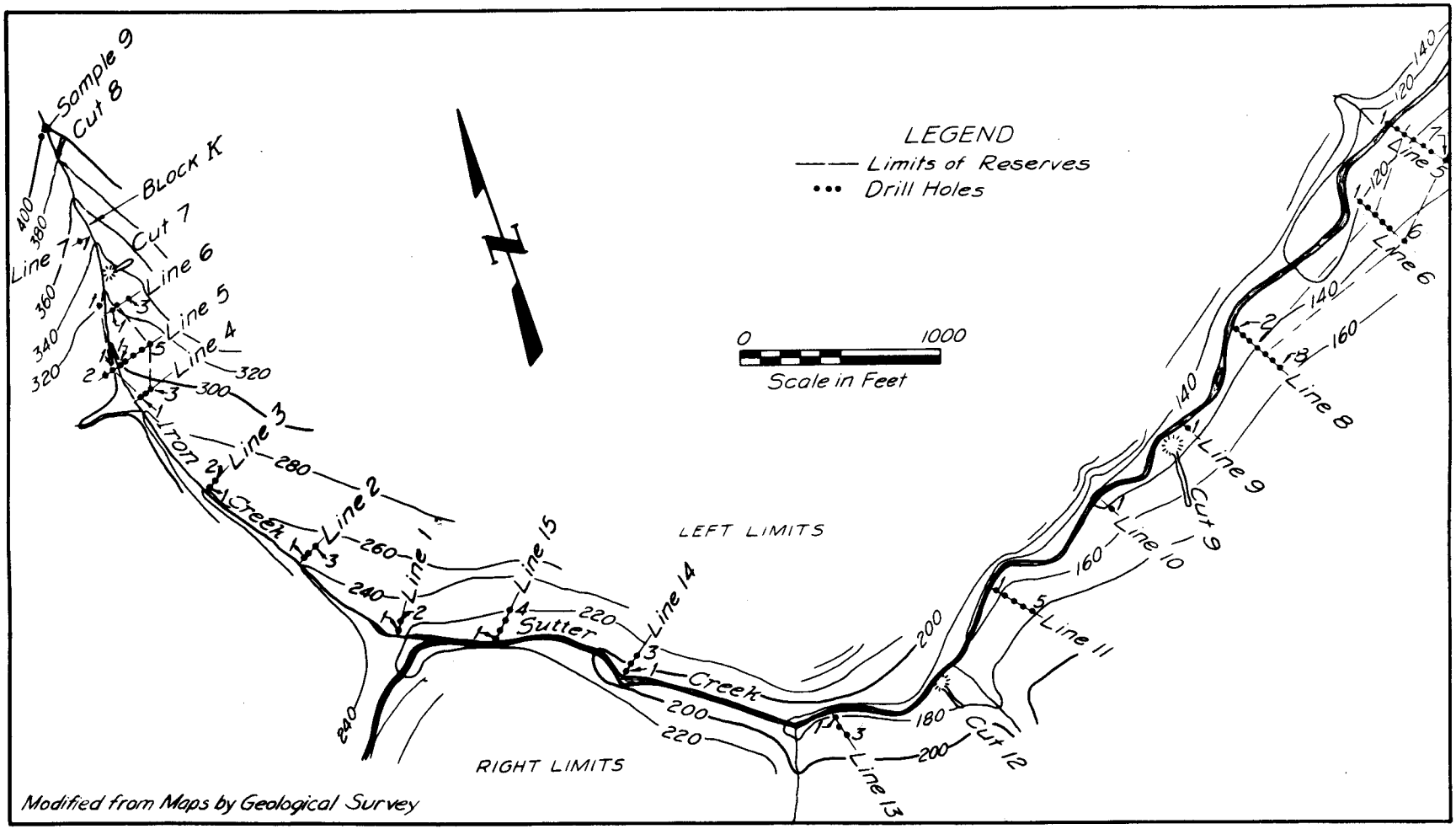

Figure 5. - Drill-hole map of Sutter and Iron Creeks.

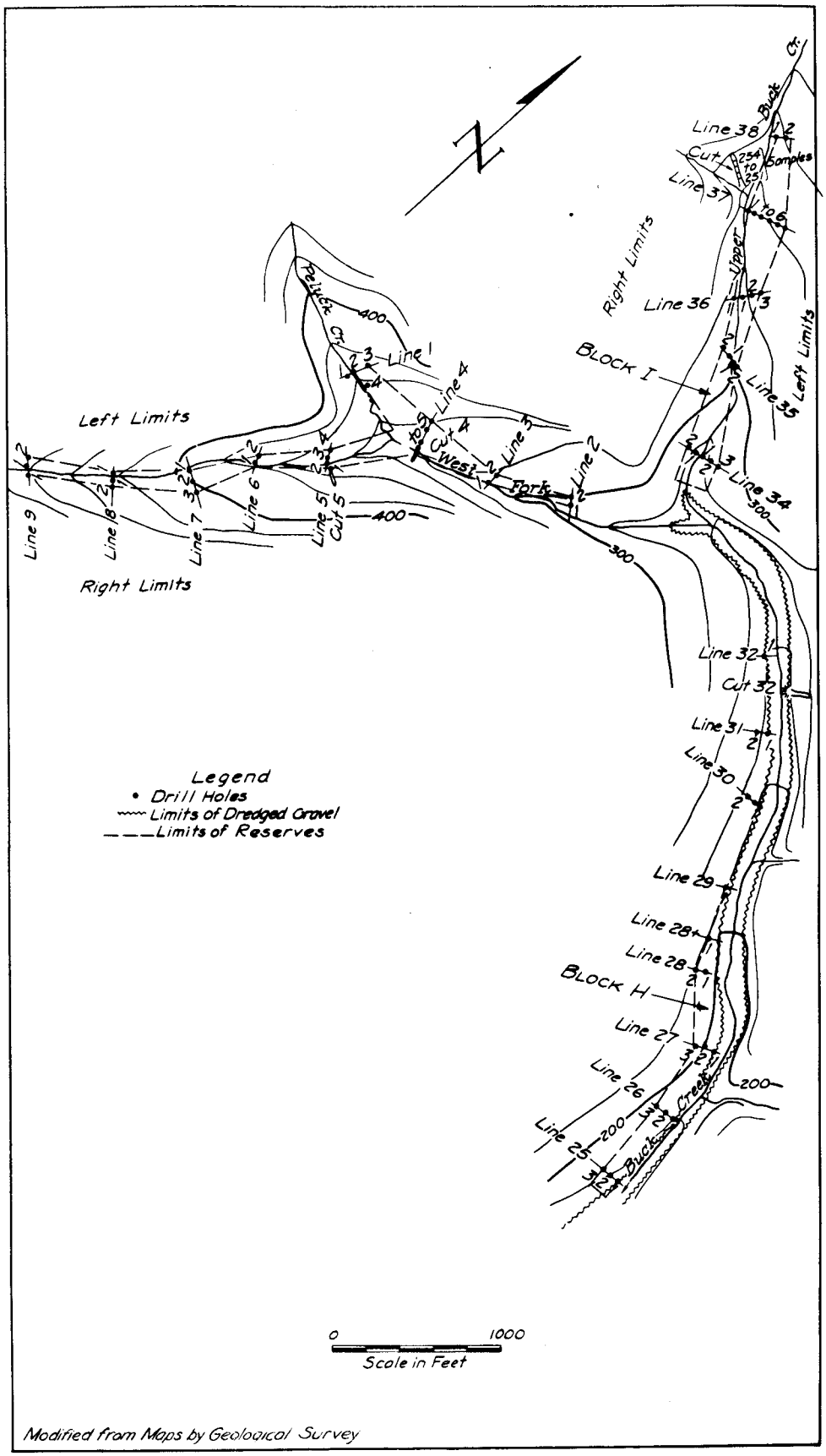

Figure 6. - Drill-hole map of Buck, West Fork, and Peluck Creeks.

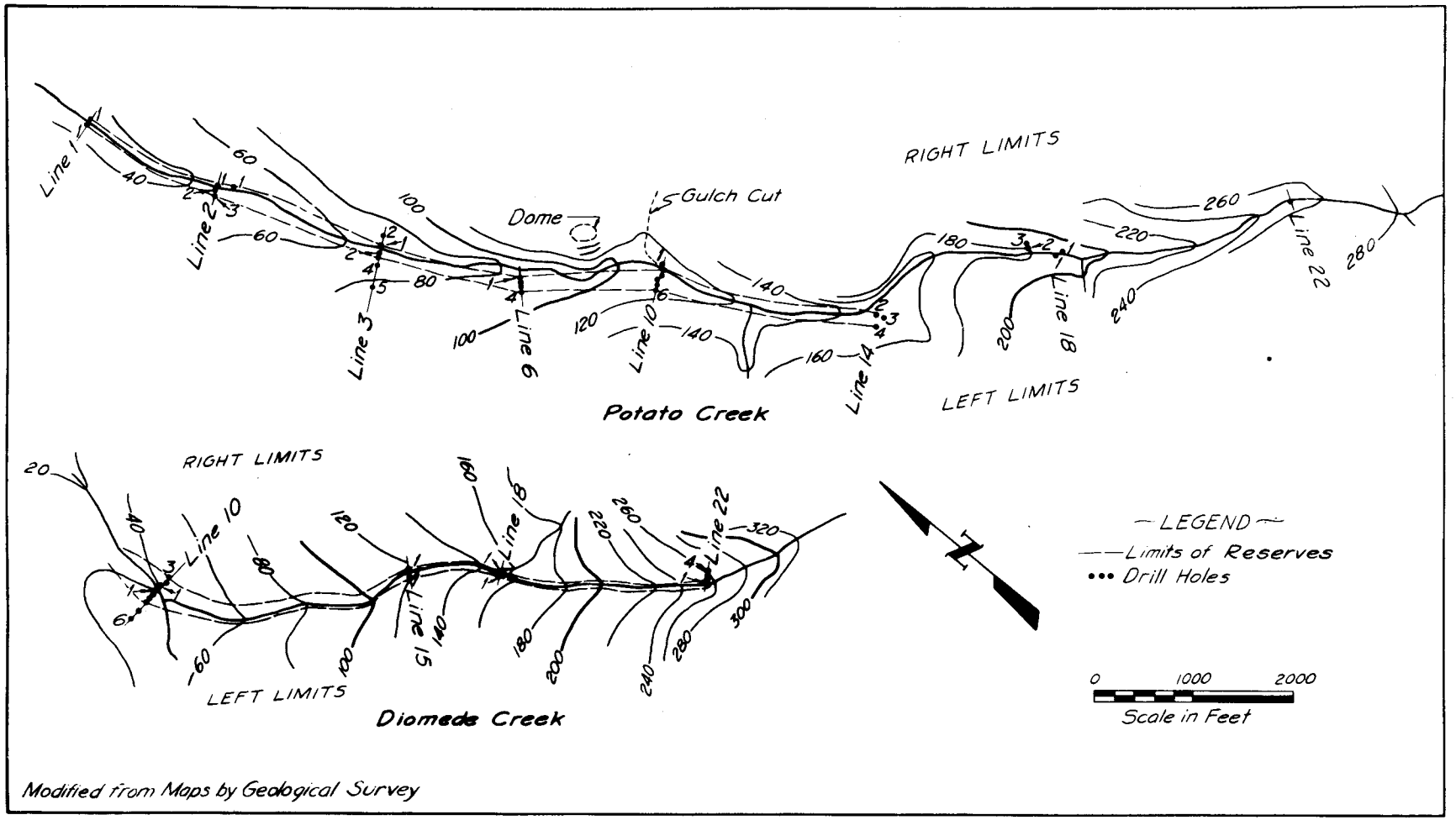

Figure 7. - Drill-hole map of Potato Creek and Diomede Creek.

TABLE 1. - Tin Analysis of composite concentrate of placer samples (Cont'd.)
(Analysis at Bureau of Mines Laboratory, Rolla, Mo.)

Source of sample	Tin, percent	Weighted average, tin percent
Buck Creek (Left Fork and Up L 25 to L 38, Composite of samples between 15 to 4 grams	56.32	58.64
Buck Creek (Left Fork and Up) L 25 to L 38, Composite of samples over 15 grams	59.30	
West Fork Composite of samples between 15 to 4 grams	52.60	56.97
West Fork Composite of samples over 15 grams	58.62	
Iron Creek Composite of samples between 15 to 4 grams	50.80	57.40
Iron Creek Composite of samples over 15 grams	59.87	
Grouse Creek Composite of samples between 15 to 4 grams	53.17	56.95
Grouse Creek Composite of samples over 15 grams	57.25	
Sutter Creek L 1 to L 15 Composite of samples between 15 to 4 grams	63.00	64.65
Sutter Creek L 1 to L 15 Composite of samples over 15 grams	67.57	
Peluk Creek L 1 Composite of samples above 15 grams	53.55	53.46
Peluk Creek L 1 Composite of samples between 4 to 15 grams	53.16	
Potato Creek Composite of samples between 4 to 15 grams	45.42	
Diomede Creek Composite of samples between 4 to 15 grams	35.35	

Formulas as used in calculating the churn drill holes are as follows:

$$\frac{(\text{Weight of concentrate, in grams})(0.0595)(\text{percent tin in concentrate})}{(\text{Volume of pay horizon})} = \text{Pound of tin per cubic yard.}$$

$$\frac{27}{453.6} = 0.0595$$

where: 27 = number of cubic feet in a cubic yard

453.6 = number of grams in 1 pound avoirdupois.

The percent tin in concentrate is the weighted average of the composite samples of concentrate between 4 to 15 grams and samples over 15 grams.

The pay horizon (P. H.) is the vertical section of each drill hole in which tin concentrate was found.

The term mining section (M. S.) is used to designate the material in the vertical section of each drill hole that would be sluiced to obtain an efficient recovery of tin concentrate. The mining section, in this case, includes all the gravel and a minimum of 1 foot of bedrock.

The grade of the mining section for each drill hole was calculated as follows:

$$\frac{(\text{Depth of pay horizon})(\text{pounds of tin per cubic yard in pay horizon})}{(\text{Depth of mining section})} = \text{Pound of tin per cubic yard (M. S.)}$$

Where casing was used, the area of the drive shoe was used to calculate volumes. No adjustments of thawed volumes to frozen volumes were made. Water measured volumes were used for calculating frozen holes.

In all cases, the overburden was estimated separately from the gravel and bedrock. The tabulations of drilling results are given in tables 2 to 9, inclusive.

In conjunction with the drill sampling, six trenches were bulldozed to bedrock and sampled. Table 10 is a summary of the results from trench sampling.

PLACER WORKINGS

Grouse Creek was dredged from the mouth of Buck Creek downstream to East Fork, a distance of about 5,000 feet. Immediately below East Fork, a reef extending across Grouse Creek apparently acted as a trap, as no tin concentration was found below this reef.

The dredges worked about 15,000 feet of Buck Creek from its mouth to West Fork. Five small deposits were left alongside the dredge channel.

A 1,500-foot section of Iron Creek was hand-mined in a narrow strip up the center of the present channel. Very little tin was left.

Left Fork was hand-mined from its mouth 600 feet upstream. A narrow, shallow bench on the left limit of the worked portion was previously tested by Thomas J. Christensen, a local operator. Very little gravel and only traces of tin now exist above the mined ground on Left Fork.

West Fork was hand-mined up the present channel 900 feet above its mouth. A small bench still remains on the left limit, and a low-grade deposit exists above the workings.

TABLE 2. - Summary of drilling results on Grouse Creek (fig. 3)

Line No.	Hole No.	Total depth, feet	Over-burden, feet	Gravel, feet	Pay horizon, feet	Bedrock mining sec., feet	Mining section, feet	Pound concentrate per cubic yards, mining section	Pound tin per cubic yards, mining section	Thawed or frozen
5.....	1 (L.L.)	9.0	2.0	5.0	3.0	1.0	6.0	0.072	0.04	Th.
	1 (R.L.)	5.0	0.0	4.0	3.0	1.0	5.0	0.085	0.05	Th.
	2	10.0	0.0	8.0	4.0	1.0	9.0	0.201	0.11	Th.
	3	6.0	1.0	4.0	3.0	1.0	5.0	0.348	0.20	Th.
7.....	1	6.0	3.0	2.0	1.5	1.0	3.0	0.028	0.02	Fr.
8.....	1 (R.L.)	8.0	2.0	4.0	3.0	1.0	5.0	0.167	0.10	Fr.
	2 (R.L.)	7.0	2.0	4.0	4.0	1.0	5.0	0.160	0.09	Fr.
	3 (R.L.)	8.0	1.0	5.5	3.0	1.0	6.5	0.056	0.03	Th.
	4 (R.L.)	6.0	1.0	4.0	1.0	1.0	5.0	0.004	Trace	Th.
	5 (R.L.)	11.0	2.0	5.0	0.0	0.0	0.0	0.000	0.00	Fr.
9.....	1	9.0	4.0	4.0	4.0	1.0	5.0	0.602	0.34	Fr.
	1X	7.0	3.0	3.0	2.0	1.0	4.0	0.035	0.02	Fr.
	2	6.0	2.0	3.0	3.0	1.0	4.0	0.028	0.01	Fr.
	3	8.0	3.0	3.0	4.0	1.0	4.0	0.073	0.04	Fr.
8.....	1 (L.L.)	14.0	5.0	7.0	5.0	1.0	8.0	1.675	0.95	Fr.
10.....	2 (L.L.)	17.0	6.0	9.0	6.0	1.0	10.0	2.699	1.53	Fr.
	1 (L.L.)	13.0	4.0	7.5	7.0	1.5	9.0	11.805	6.70	Fr.
10.....	1 (R.L.)	8.0	3.0	3.0	4.0	1.0	4.0	0.975	0.55	Fr.
	2 (R.L.)	9.0	4.0	3.0	3.0	1.0	4.0	0.030	0.02	Fr.
11.....	1	10.0	3.0	6.0	6.0	1.0	7.0	1.573	0.89	Fr.
	2	13.5	3.0	8.0	10.0	2.0	10.0	0.854	0.48	Fr.
	3	11.0	3.5	5.5	4.5	1.0	6.5	0.005	Trace	Fr.

TABLE 3. - Summary of drilling results on Buck Creek (figs. 3 and 4)

Line No.	Hole No.	Total depth, feet	Over-burden, feet	Gravel, feet	Pay horizon, feet	Bedrock mining sec., feet	mining section, feet	Pound concentrate per cubic yards, mining section	Pound tin per cubic yards, mining section	Thawed or frozen
12.....	1	10.0	4.0	4.0	5.0	1.0	5.0	1.373	0.90	Fr.
	2	7.0	4.0	2.0	4.0	2.0	4.0	0.053	0.03	Fr.
13.....	1	9.5	4.0	4.0	4.0	1.0	5.0	0.589	0.38	Th.
	2	9.0	4.0	4.0	3.0	1.0	5.0	0.060	0.04	Fr.
13+.....	1	11.0	6.0	3.5	3.0	1.0	4.5	3.311	2.17	Fr.
14.....	1	8.0	5.0	2.0	0.0	0.0	0.0	0.000	0.00	Fr.
14+.....	1	7.0	4.0	1.0	2.0	1.0	2.0	0.075	0.05	Th.
15.....	1	6.0	3.0	2.0	2.0	1.0	3.0	0.206	0.13	Fr.
15-1.....	3	8.0	3.0	4.0	3.0	1.0	5.0	0.188	0.12	Fr.
	2	6.0	3.0	2.0	2.0	1.0	3.0	0.451	0.29	Fr.
	1	7.0	3.0	3.0	3.0	1.0	4.0	0.319	0.21	Fr.
15-2.....	2	10.0	3.0	3.0	4.0	1.0	4.0	0.188	0.12	Th.
	1	8.0	4.0	3.0	4.0	1.0	4.0	2.539	1.66	Fr.
16.....	6	13.0	4.0	4.0	3.0	1.0	5.0	0.131	0.08	Fr.
	5	9.0	3.0	2.0	3.0	1.0	3.0	1.316	0.86	Fr.
	4	8.0	4.0	3.0	3.0	1.0	4.0	0.583	0.38	Fr.
	3	9.0	3.0	5.0	4.0	1.0	6.0	1.655	1.08	Fr.
	2	8.0	2.0	5.0	5.0	1.0	6.0	8.146	5.34	Fr.
	1	9.0	3.0	4.0	5.0	1.0	5.0	1.223	0.80	Fr.

TABLE 3. - Summary of drilling results on Buck Creek (fig. 4)(Cont'd.)

Line No.	Hole No.	Total depth, feet	Over-burden, feet	Gravel, feet	Pay horizon, feet	Bedrock mining sec., feet	Mining section, feet	Pound concentrate per cubic yards, mining section	Pound tin per cubic yards, mining section	Thawed or frozen
17-1	2	10.0	5.0	3.0	3.0	1.0	4.0	1.261	0.70	Fr.
	1	8.0	3.0	4.0	4.0	1.0	5.0	2.822	1.56	Th.
17	3	11.0	7.0	1.0	1.0	1.0	2.0	0.338	0.19	Fr.
	2	11.5	3.0	8.0	8.0	1.0	9.0	1.618	0.89	Fr.
	1	7.5	2.0	5.5	4.5	1.0	6.5	8.786	4.87	Th.
18	1 (L.L.)	14.0	6.0	5.5	5.0	1.0	6.5	2.991	1.66	Th.
	1 (R.L.)	8.0	4.0	2.0	2.0	1.0	3.0	0.470	0.26	Fr.
	2 (L.L.)	13.0	4.0	8.0	3.0	1.0	9.0	0.263	0.14	Fr.
20 (R.L.)	1	9.0	0.0	7.0	3.0	1.0	8.0	0.263	0.14	Th.
	2	10.0	4.0	4.5	5.0	1.0	5.5	0.602	0.33	Fr.
	3	8.0	3.0	3.0	3.0	1.0	4.0	0.339	0.19	Fr.
20 (L.L.)	3	7.0	5.0	0.0	0.0		0.0	0.000	0.00	Fr.
	2	11.5	5.0	4.0	3.4	1.0	5.0	7.413	4.11	Fr.
	1	9.5	4.0	4.0	4.0	1.0	5.0	5.324	2.95	Th.
21	1	13.0	3.0	7.0	3.0	1.0	8.0	0.639	0.35	Fr.
	2	13.0	3.0	7.0	4.0	1.0	8.0	0.527	0.29	Fr.
21+	1	15.0	9.0	4.0	5.0	1.0	5.0	0.809	0.45	Fr.
	2	16.0	5.0	8.0	0.0		8.0	0.000	0.00	Fr.
22	1	18.0	4.0	12.0	5.0	1.0	13.0	4.910	2.72	Fr.
	2	15.0	4.0	9.0	4.0	1.0	10.0	0.903	0.50	Fr.
23	1	9.0	5.0	2.5	3.0	1.0	3.5	17.139	9.50	Fr.
	2	10.0	6.0	2.0	3.0	1.0	3.0	8.842	4.90	Fr.
	3	11.0	3.5	5.5	2.0	1.0	6.5	0.564	0.31	Th.
	4	10.0	8.0	0.0	0.0		0.0	0.000	0.00	Fr.

TABLE 3. - Summary of drilling results on Buck Creek (figs. 4 and 6)(Cont'd.)

Line No.	Hole No.	Total depth, feet	Overburden, feet	Gravel, feet	Pay horizon, feet	Bedrock, mining sec., feet	Mining section, feet	Pound concentrate per cubic yards, mining section	Pound tin per cubic yards, mining section	Thawed or frozen
23+	1	10.0	4.0	4.0	4.0	1.0	5.0	7.770	4.31	Th.
	2	9.0	5.0	2.0	2.0	1.0	3.0	0.376	0.21	Fr.
24	1	7.0	5.5	0.0	0.0		0.0	0.000	0.00	Th.
				Tin Creek						
1	1	8.0	6.0	0.0						Th.

TABLE 3. - Summary of drilling results on Buck Creek (figs. 4 and 6)(Cont'd.)

25	1	13.0	7.5	3.5	3.0	1.0	4.5	5.441	3.19	Fr.
	2	16.0	8.5	4.5	3.0	1.0	5.5	1.037	0.61	Fr.
	3	11.0	3.0	5.0	5.0	1.0	6.0	0.200	0.12	Fr.
26	1	10.0	0.0	6.0	5.0	1.0	7.0	0.637	0.37	Th.
	2	13.0	5.0	5.0	5.0	1.0	6.0	0.400	0.23	Th.
	3	7.0	3.5	1.5	2.5	1.0	2.5	0.400	0.23	Fr.
27	1	8.0	1.0	4.0	4.0	1.0	5.0	1.310	0.77	Th.
	2	7.5	2.0	3.5	3.5	1.0	4.5	0.709	0.41	Fr.
	3	10.0	2.0	5.0	4.0	1.0	6.0	0.218	0.13	Fr.
28	1	9.5	4.0	3.5	3.5	2.0	5.5	3.620	2.32	Fr.
	2	18.0	3.0	13.0	10.0	1.0	14.0	0.182	0.11	Fr.
28+	1	14.0	7.0	4.0	4.0	1.0	5.0	1.383	0.81	Fr.
29	1	12.0	6.0	3.0	3.0	1.0	4.0	0.910	0.53	Fr.
30-	1	8.0	4.0	2.0	2.0	1.0	3.0	0.044	0.02	Fr.
30	1 (R.L.)	9.0	4.0	2.0	0.0	0.0	0.0	0.000	0.00	Fr.
30	2 (R.L.)	8.0	3.5	1.5	2.5	1.0	2.5	0.228	0.13	Fr.

TABLE 3. - Summary of drilling results on Buck Creek (figs. 4 and 6)(Cont'd.)

Line No.	Hole No.	Total depth, feet	Over-burden, feet	Gravel, feet	Pay horizon, feet	Bedrock, mining sec., feet	Mining section, feet	Pound concentrate per cubic yards, mining section	Pound tin per cubic yards, mining section	Thawed or frozen
31	1	9.0	4.5	2.5	2.5	1.0	3.5	0.626	0.36	Fr.
	2	10.0	3.0	5.0	2.5	1.0	6.0	0.683	0.40	Fr.
32	1	7.5	3.0	3.0	3.5	1.0	4.0	0.135	0.08	Fr.
34	3 (L.L.)	8.5	4.0	1.0	3.0	2.0	3.0	0.455	0.26	Fr.
	2 (L.L.)	10.0	2.5	2.5	2.5	1.0	3.5	1.183	0.69	Fr.
	1 (L.L.)	6.0	2.0	2.5	3.0	1.0	3.5	2.820	1.65	Fr.
	1 (R.L.)	4.5	0.5	3.0	4.0	1.0	4.0	4.986	2.92	Th.
	2 (R.L.)	8.0	4.0	2.0	2.0	1.0	3.0	0.091	0.05	Fr.
35	2 (L.L.)	9.0	4.5	2.5	2.0	1.0	3.5	1.073	0.63	Fr.
	1 (L.L.)	11.0	4.5	2.5	4.5	2.0	4.5	3.221	1.89	Fr.
	1 (R.L.)	9.0	5.0	2.5	3.0	1.0	3.5	1.710	1.00	Fr.
	2 (R.L.)	8.0	5.0	1.0	2.0	1.0	2.0	0.345	0.20	Fr.

TABLE 3. - Summary of Drilling results on Buck Creek (fig. 6)

36	3 (L.L.)	15.0	9.0	4.0	5.0	1.0	5.0	0.364	0.21	Fr.
	2 (L.L.)	14.0	3.5	6.5	4.0	1.0	7.5	0.709	0.41	Fr.
	1 (L.L.)	8.0	5.0	0.5	2.0	1.5	2.0	1.073	0.63	Th.
	1 (R.L.)	6.5	5.0	0.5	1.0	1.0	1.5	0.473	0.28	Th.
37	6	21.0	14.0	5.0	3.0	1.0	6.0	0.618	0.36	Fr.
	5	19.0	11.0	6.0	3.0	1.0	7.0	3.057	1.79	Fr.
	4	16.0	11.0	4.0	4.0	1.0	5.0	3.857	1.67	Fr.
	3	13.0	8.0	3.0	4.0	1.0	4.0	2.493	1.46	Fr.
	2	10.5	6.5	2.0	3.0	1.0	3.0	2.220	1.30	Fr.
	1	4.0	0.0	2.0	4.0	2.0	4.0	2.802	1.64	Th.
38	2	15.0	8.0	4.0	3.0	1.0	5.0	0.327	0.19	Fr.
	1	6.0	4.0	1.0	0.0	0.0	0.0	0.000	0.00	Fr.

TABLE 4. - Summary of drilling results on West Fork (fig. 6)

Line No.	Hole No.	Total depth, feet	Overburden, feet	Gravel, feet	Pay horizon, feet	Bedrock, mining sec., feet	Mining section, feet	Pound concentrate per cubic yards, mining section	Pound tin per cubic yards, mining section	Thawed or frozen
2	2	9.0	4.0	3.0	2.0	1.0	4.0	0.181	0.10	Fr.
	1	9.0	5.0	2.0	1.0	1.0	3.0	0.617	0.34	Th.
3	2	9.0	4.0	3.0	2.0	1.0	4.0	0.076	0.04	Fr.
	1	6.0	2.0	2.5	3.0	1.0	3.5	0.608	0.35	Fr.
4	5	16.0	9.0	3.5	5.0	1.5	5.0	1.312	0.75	Fr.
	4	12.0	10.0	2.0	2.0	1.0	3.0	1.456	0.97	Th.
	3	10.0	7.0	1.0	2.0	1.0	2.0	0.855	0.49	Fr.
	2	6.0	3.0	1.0	2.0	1.0	2.0	2.947	1.68	Th.
	1	6.0	0.0	4.0	1.0	1.0	5.0	0.124	0.07	Th.
5	4	7.0	3.0	2.0	3.0	1.0	3.0	0.988	0.85	Fr.
	3	7.0	4.0	1.0	2.0	1.0	2.0	10.494	5.98	Th.
	2	4.0	0.0	3.0	3.0	1.0	4.0	0.361	0.20	Th.
	1	4.0	0.0	3.0	0.0		0.0	0.000	0.00	Th.
6	2	6.5	5.0	1.0	1.5	1.0	2.0	0.551	0.31	Th.
	1	4.0	0.0	3.0	3.0	1.0	4.0	0.095	0.05	Th.
7	1	14.0	7.0	3.0	3.0	1.0	4.0	1.045	0.59	Th.
	2	16.0	9.0	3.0	4.0	1.0	4.0	3.612	2.06	Fr.
	3	15.0	10.0	2.0	3.0	1.0	3.0	1.065	0.61	Fr.
8	1 (L.L.)	15.0	7.0	6.0	5.0	1.0	7.0	0.551	0.31	Th.
	1 (R.L.)	16.0	8.0	6.0	6.0	1.0	7.0	5.019	2.86	Fr.
	2	11.0	6.0	3.5	4.0	1.0	4.5	0.551	0.31	Fr.
9	2	21.0	15.0	4.0	4.0	1.0	5.0	0.247	0.14	Th.
	1 (L.L.)	17.0	10.0	5.0	5.0	1.0	6.0	2.528	1.44	Th.
	1 (R.L.)	17.0	9.0	7.0	6.0	1.0	8.0	0.133	0.07	Th.

TABLE 5. - Summary of drilling results on Iron Creek (fig. 5)

Line No.	Hole No.	Total depth, feet	Over-burden, feet	Gravel, feet	Pay horizon, feet	Bedrock, mining sec., feet	Mining section, feet	Pound concentrate per cubic yards, mining section	Pound tin per cubic yards, mining section	Thawed or frozen
1.....	1	6.0	3.0	1.0	2.0	1.0	2.0	1.446	0.83	Fr.
	2	6.0	2.0	2.0	3.0	1.0	3.0	0.266	0.15	Fr.
2.....	1	12.0	9.0	0.0	0.0		0.0	Trace	Trace	Th.
	2	10.0	4.0	4.0	4.0	1.0	5.0	0.704	0.40	Th.
	3	9.0	3.0	4.0	0.0	0.0	0.0	Trace	Trace	Fr.
3.....	1	9.0	6.0	1.0	0.0	0.0	0.0	Trace	Trace	Fr.
	2	12.0	9.0	0.0	0.0	0.0	0.0	Trace	Trace	Fr.
4.....	1	10.0	3.0	4.5	3.0	1.0	5.5	0.418	0.24	Fr.
	2	13.0	4.0	5.0	5.0	1.0	6.0	0.780	0.45	Fr.
	3	17.5	3.0	10.0	6.0	1.0	11.0	0.100	0.06	Fr.
5.....	2 (R.L.)	17.0	3.0	9.0	0.0		0.0	Trace	Trace	Fr.
	1 (R.L.)	11.0	5.0	4.0	5.0	1.0	5.0	1.769	1.01	Th.
	1	10.0	3.0	5.5	3.0	1.0	6.5	0.270	0.15	Th.
	2	11.0	4.0	5.0	3.0	1.0	6.0	0.209	0.12	Th.
	3	15.5	5.0	7.0	8.0	1.0	8.0	1.560	0.89	Fr.
	4	18.0	10.0	5.0	5.0	1.0	6.0	2.302	1.32	Fr.
	5	20.0	5.0	9.0	9.0	1.0	10.0	0.155	0.09	Fr.
6.....	1 (R.L.)	12.0	3.0	6.0	5.0	1.0	7.0	0.190	0.11	Fr.
	1 (L.L.)	11.0	3.0	6.0	5.0	1.0	7.0	0.533	0.30	Fr.
	2	17.0	3.0	9.0	10.0	1.0	10.0	1.503	0.86	Fr.
	3	19.0	2.0	13.0	0.0		0.0	Trace	Trace	Fr.
7.....	1	14.0	4.0	8.0	8.0	1.0	9.0	1.522	0.87	Fr.

TABLE 6. - Summary of drilling results on Peluk Creek (fig. 6)

Line No.	Hole No.	Total depth, feet	Over-burden, feet	Gravel, feet	Pay horizon, feet	Bedrock, mining sec., feet	Mining section, feet	Pound concentrate per cubic yards, mining section	Pound tin per cubic yards, mining section	Thawed or frozen
1	4	18.0	13.0	3.0	4.0	1.0	4.0	1.443	0.77	Th.
	3	7.0	3.0	2.5	3.0	1.0	3.5	0.415	0.22	Th.
	2	7.0	0.0	4.0	1.0	1.0	5.0	0.079	0.04	Th.
	1	9.0	7.0	1.0	1.0	1.0	2.0	0.020	0.01	Th.

TABLE 7. - Summary of drilling results on Sutter Creek (figs. 4 and 5)

Line No.	Hole No.	Total depth, feet	Over-burden, feet	Gravel, feet	Pay horizon, feet	Bedrock, mining sec., feet	Mining section, feet	Pound concentrate per cubic yards, mining section	Pound tin per cubic yards, mining section	Thawed or frozen
1-S	1	7.0	4.0	2.0	0.0		0.0	0.000	0.00	Fr.
2	1	6.0	0.0	5.0	3.0	1.0	6.0	0.076	0.05	Th.
	2	6.0	0.0	5.0	3.0	1.0	6.0	0.057	0.04	Th.
	3	8.0	3.5	1.5	3.5	2.0	3.5	0.171	0.11	Th.
	4	10.0	5.0	3.5	4.0	1.0	4.5	0.361	0.23	Fr.
	5	9.0	4.0	3.5	4.5	1.0	4.5	0.476	0.31	Fr.
4	1	7.0	6.0	0.0	0.0		0.0	0.000	0.00	Th.
	2	9.0	0.0	8.0	3.0	1.0	9.0	0.228	0.15	Th.
	3	8.0	0.0	5.0	4.0	1.0	6.0	0.019	0.01	Th.
	4	10.0	4.0	4.0	5.0	1.0	5.0	0.038	0.02	Th.
	5	7.0	2.0	3.0	3.0	1.0	4.0	0.951	0.61	Th.
	6	8.0	2.0	3.0	3.0	1.0	4.0	0.361	0.23	Fr.
	8	7.0	2.0	3.0	3.0	1.0	4.0	0.076	0.05	Fr.
5	1	7.0	0.0	6.0	3.0	1.0	7.0	0.019	0.01	Th.
	2	10.0	1.0	5.0	0.0		0.0	0.000	0.00	Fr.
	3	8.0	2.0	3.0	3.0	1.0	4.0	0.019	0.01	Th.
	4	7.0	2.0	3.0	3.0	1.0	4.0	0.818	0.53	Fr.
	5	8.0	2.0	4.5	4.0	1.0	5.5	0.932	0.60	Fr.
	6	7.0	2.0	3.0	3.0	1.0	4.0	0.038	0.02	Fr.
	7	11.0	2.0	7.0	4.0	1.0	8.0	0.038	0.02	Fr.
6	1	10.0	4.0	5.0	3.0	1.0	6.0	Trace	Trace	Fr.
	2	10.0	3.0	5.0	2.0	1.0	6.0	Trace	Trace	Fr.
	3	12.0	4.0	5.0	4.0	1.0	6.0	0.038	0.02	Fr.
	4	15.0	4.0	9.0	7.0	1.0	10.0	1.541	0.99	Fr.
	5	17.0	5.0	10.0	2.0	1.0	11.0	0.095	0.06	Fr.
	6	14.0	4.0	8.0	3.0	1.0	9.0	0.057	0.04	Fr.

TABLE 7. - Summary of drilling results on Sutter Creek (fig. 5)

Line No.	Hole No.	Total depth, feet	Over-burden, feet	Gravel, feet	Pay horizon, feet	Bedrock, mining sec., feet	Mining section, feet	Pound concentrate per cubic yards, mining section	Pound tin per cubic yards, mining section	Thawed or frozen
8.....	2	10.0	3.0	3.0	5.0	2.0	5.0	0.342	0.22	Fr.
	3	10.0	3.0	4.0		0.0	0.0	0.000	0.00	Th.
	4	10.0	3.0	4.0	2.0	1.0	5.0	0.209	0.01	Fr.
	5	12.0	3.0	7.0	4.0	1.0	8.0	0.285	0.18	Th.
	6	13.0	3.0	7.0	3.0	1.0	8.0	0.342	0.22	Fr.
	7	14.0	5.0	5.0	2.0	1.0	6.0	0.019	0.01	Fr.
	8	10.0	4.0	3.0	0.0		0.0	Trace	Trace	Fr.
9.....	1	7.0	0.0	6.0	0.0		0.0	Trace	Trace	Th.
10.....	1	9.0	3.0	3.0	0.0		0.0	0.000	0.00	Th.
11.....	1	6.0	3.0	1.0	1.0	1.0	2.0	0.171	0.11	Th.
	2	6.0	3.0	2.0	0.0	0.0	0.0	Trace	Trace	Fr.
	3	7.0	3.0	2.0	3.0	1.0	3.0	0.133	0.08	Fr.
	4	9.0	4.0	2.0	3.0	1.0	3.0	0.152	0.10	Fr.
	5	6.0	3.0	1.0	2.0	1.0	2.0	0.323	0.21	Th.
13.....	1	6.0	0.0	5.0	0.0	0.0	0.0	Trace	Trace	Th.
	2	8.0	3.0	3.0	0.0	0.0	0.0	0.000	0.00	Fr.
	3	6.0	3.0	2.0	0.0	0.0	0.0	0.000	0.00	Fr.
14.....	1	11.0	4.0	3.0	5.0	2.0	5.0	0.418	0.27	Fr.
	2	12.0	4.0	4.0	6.0	2.0	6.0	0.571	0.37	Fr.
	3	6.0	3.0	2.0	2.0	1.0	3.0	0.171	0.11	Th.
15.....	1	7.0	4.0	1.0	0.0	0.0	0.0	Trace	Trace	Th.
	2	10.0	7.0	1.0	2.0	1.0	2.0	0.114	0.07	Fr.
	3	10.0	5.0	3.0	0.0	0.0	0.0	Trace	Trace	Fr.
	4	6.0	4.0	0.0	0.0	0.0	0.0	Trace	Trace	Fr.

TABLE 8. - Summary of drilling results on Potato Creek (fig. 7)

Line No.	Hole No.	Total depth, feet	Over-burden, feet	Gravel, feet	Pay horizon, feet	Bedrock mining sec., feet	Mining section, feet	Pound concentrate per cubic yards, mining section	Pound tin per cubic yards, mining section	Thawed or frozen
1.....	1	12.0	4.0	6.0	0.0	0.0	0.0	-	Trace	Fr.
	1 (R)	30.0	24.0	5.0	5.0	1.0	6.0	-	0.27	Fr.
2.....	1 (R)	11.0	5.0	4.0	0.0	0.0	0.0	-	Trace	Fr.
	1	10.0	0.0	8.0	5.0	1.0	9.0	-	0.05	Fr.
	2 (L)	9.0	3.0	4.0	5.0	1.0	5.0	-	0.31	Fr.
	3 (L)	11.0	4.0	5.0	5.0	1.0	6.0	-	0.14	Fr.
3.....	1	15.0	6.0	4.0	4.0	1.0	5.0	-	0.22	Fr.
	2	14.0	7.0	4.0	0.0	0.0	0.0	-	0.00	Fr.
	2 (L)	14.0	6.0	6.0	4.0	1.0	7.0	-	0.24	Fr.
	3	20.0	7.0	8.0	4.0	1.0	9.0	-	0.38	Fr.
	4	16.0	5.0	10.0	0.0	0.0	0.0	-	0.00	Fr.
	5	11.0	9.0	1.0	0.0	0.0	0.0	-	0.00	Fr.
6.....	1 (L)	10.0	6.0	2.0	2.0	1.0	3.0	-	0.10	Fr.
	2	12.0	3.0	5.0	7.0	2.0	7.0	-	0.19	Fr.
	3	12.0	6.0	4.0	4.0	1.0	5.0	-	0.54	Fr.
	4	16.0	5.0	7.0	2.0	1.0	8.0	-	0.14	Fr.
10.....	1 (R)	12.0	0.0	9.0	0.0	0.0	0.0	-	Trace	Th.
	2 (L)	10.0	5.0	3.0	3.0	1.0	4.0	-	0.07	Fr.
	3	18.0	3.0	7.0	7.0	1.0	8.0	-	0.14	Fr.
	4	14.0	5.0	5.0	3.0	1.0	6.0	-	0.10	Fr.
	5	17.0	8.0	6.0	6.0	1.0	7.0	-	0.21	Fr.
	6	15.0	8.0	6.0	3.0	1.0	7.0	-	0.06	Fr.
14.....	2 (L)	9.0	3.0	5.0	3.0	1.0	6.0	-	0.05	Th.
	3	8.5	3.0	3.5	4.5	1.0	4.5	-	0.15	Fr.
	4	10.0	4.0	4.0	4.0	1.0	5.0	-	0.19	Fr.
18.....	1	8.0	4.0	2.0	0.0	0.0	0.0	-	0.00	Fr.
	1 (R)	9.0	3.0	4.0	0.0	0.0	0.0	-	0.00	Th.
	2 (R)	13.0	9.0	2.0	0.0	0.0	0.0	-	0.00	Fr.
	3 (R)	7.5	5.0	1.5	0.0	0.0	0.0	-	0.00	Fr.
22.....	1 (R)	14.0	4.5	2.0	0.0	0.0	0.0	-	0.00	Th.

TABLE 9. - Summary of drilling results on Diomede Creek (fig. 7)

Line No.	Hole No.	Total depth feet	Overburden, feet	Gravel, feet	Pay horizon, feet	Bedrock mining sec., feet	Mining section, feet	Pound concentrate per cubic yards, mining section	Pound tin per cubic yards, mining section	Thawed or frozen
10.....	1 (L)	10.0	3.0	4.0	4.0	1.0	5.0	-	0.24	Fr.
	2 (L)	10.0	3.0	5.0	0.0	0.0	0.0	-	0.00	Fr.
	3 (L)	17.0	7.0	8.0	0.0	0.0	0.0	-	0.00	Fr.
	4 (L)	11.0	4.0	3.0	1.0	1.0	4.0	-	0.07	Fr.
	5 (L)	10.0	3.0	5.0	3.0	1.0	6.0	-	0.04	Fr.
	6 (L)	14.0	6.0	7.0	0.0	0.0	0.0	-	0.00	Fr.
	1 (R)	17.5	4.0	11.5	4.0	1.0	12.5	-	0.11	Fr.
	2 (R)	27.0	3.0	24.0	6.0	1.0	25.0	-	0.10	Fr.
	3 (R)	17.0	7.0	6.0	2.0	1.0	7.0	-	0.16	Fr.
15.....	1	38.0	4.0	34.0	27.0	1.0	35.0	-	0.05	Fr.
	1 (L)	40.0	3.0	37.0	35.0	0.0	37.0	-	0.11	Fr.
18.....	1 (R)	13.0	4.0	6.0	4.0	1.0	7.0	-	0.07	Fr.
	1 (L)	18.0	10.0	6.0	5.0	1.0	7.0	-	0.11	Fr.
22.....	1 (R)	15.0	4.5	8.5	3.0	1.0	9.5	-	0.04	Th.
	2 (R)	20.0	5.0	6.0	2.0	1.0	7.0	-	0.04	Fr.
	3 (R)	22.0	4.0	8.0	0.0	0.0	0.0	-	0.00	Fr.
	4 (R)	11.0	6.0	3.0	0.0	0.0	0.0	-	0.00	Fr.

TABLE 10. - Summary of results from trench sampling

Creek	Cut No.	Sample No.	Total depth, feet	Depth gravel, feet	Depth, mining section, feet	Pounds concentrate per cubic yard	Pounds tin per cubic yard	Depth, O.B.
Buck (fig. 6)1/	37	1	1.7	1.7	1.7	2.5	1.46	
	37	2	2.5	2.5	2.5	10.6	6.21	
	37	3	6.4	2.5	3.6	0.63	0.37	2.8
	32	1	5.6			0.0	0.0	
Iron (fig. 6)2/	8	1	5.9	4.7	4.7	5.9	3.38	1.2
West Fork (fig. 6)	4	1	3.9	2.6	0.0	0.0	0.0	0.6
Sutter (fig. 5)3/	12	1	4.2	3.7	0.0	0.0	0.0	0.3
	12	2	6.5	2.5	0.0	0.0	0.0	4.0
	9	2	2.6	1.6	1.6	1.39	0.90	1.0
	9	3	3.0	0.0	0.0	0.0	0.0	1.9
	9	4	2.7	0.0	0.0	0.0	0.0	2.7
	9	5	4.0	0.0	0.0	0.0	0.0	3.1

1/ This concentrate contains 58.64 percent tin.
2/ This concentrate contains 57.40 percent tin.
3/ This concentrate contains 64.65 percent tin.

During the years 1911 to 1919, the York Dredging Co. and the American Tin Mining Co. dredged along Buck and Grouse Creeks. From the size of the tailing it is estimated that 568,000 cubic yards was mined. The production was 1,194 short tons of tin concentrate. This concentrate contained 812 short tons or 1,624,000 pounds of tin. The area dredged averaged approximately 4.2 pounds of concentrate recovered, or 2.86 pounds of tin per cubic yard.